

A Turbo-Brayton Cryocooler for Aircraft Superconducting Systems, Phase I

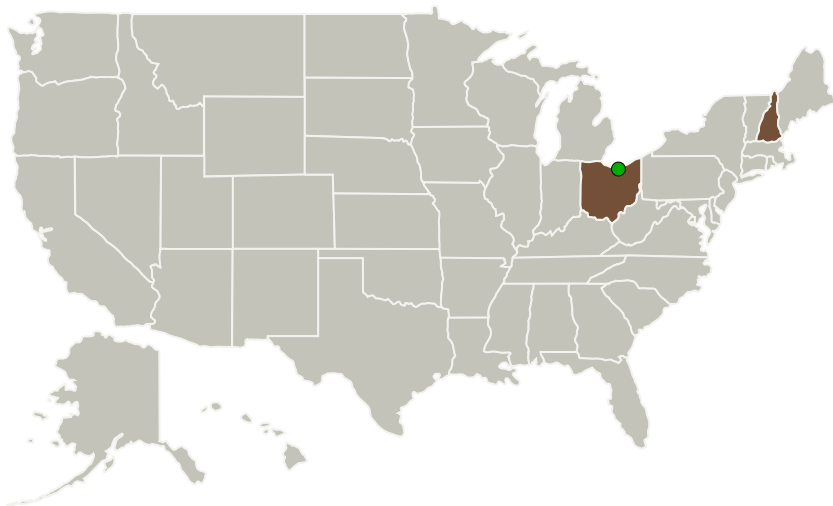
Completed Technology Project (2012 - 2012)



Project Introduction

Hybrid turbo-electric aircraft with gas turbines driving electric generators connected to electric propulsion motors have the potential to transform the aircraft design space by decoupling power generation from propulsion. Resulting aircraft designs such as blended-wing bodies with distributed propulsion can provide the large reductions in emissions, fuel burn, and noise required to make air transportation growth projections sustainable. The power density requirements for these electric machines can only be achieved with superconductors, which in turn require lightweight, high-capacity cryocoolers. We have developed a Cryoflight turbo-Brayton cryocooler concept that exceeds the mass and performance targets identified by NASA for superconducting aircraft. In Phase I of this project, we will extend our initial design study and develop modeling tools to support a system-level optimization and individual component designs. We will focus on the critical component for mass reduction—the recuperative heat exchanger—and perform risk reduction activities to demonstrate the feasibility of our concept for this component. In Phase II, we will design, build, and test a compact, lightweight, high-performance recuperator for the Cryoflight cryocooler. This development effort will provide an enabling technology for the superconducting systems needed for hybrid turbo-electric aircraft to be feasible.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
New Hampshire	Ohio

Project Transitions

**February 2012:** Project Start**August 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140253>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Creare LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Anthony J Dietz

Co-Investigator:

Anthony Dietz

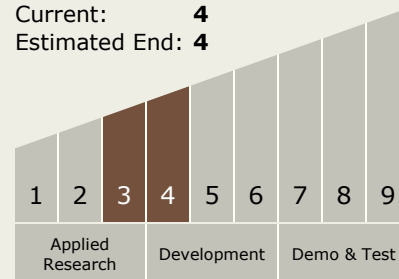
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Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System